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If even the least significant of all of the facts reported from England be accepted, we are left to deal with an unknown something quite apart from instinct, — something, for so it seems to me, which cannot be compared with it in any way, but which is the evidence of a higher order of brain-manifestation than we have yet met with.

HORATIO R. BIGELOW, M.D.

Leipzig, Feb. 28.

The tail of *Chlamydoselachus*.

A recent opportunity of examining a second specimen of *Chlamydoselachus* furnished the means of adding an item or two to our knowledge of that peculiar genus. In several points the example differed from that originally described. This was notably the case with the tail. On the later capture, this organ was a little more than one-fourth of the total length, and, with the vertebral column, tapered to a sharp extremity; whereas in the first one it stopped abruptly, with vertebrae of considerable size, as if truncate. On the new one, the lateral line, with a few short breaks posteriorly, continued to within an inch of the end of the tail. All this indicates that the tail of that which served as the type was deformed and incomplete: the deformity, in all likelihood, being of embryonic origin. Proportioned as the new one, the tail of the type would have been seventeen inches long, instead of which it was but little more than ten. Completed, the type would have had a total length of sixty-six inches, to a circumference of eleven and a half. The more recent specimen had a length of forty-eight, to a circumference of ten and a half inches, which made it rather less slender and snake-like than its predecessor.

Another difference occurred in the dentition, which, in the last examined, showed variations in the number of denticles between each lateral cusp and the median: sometimes there were two, sometimes but one.

The tropic folds, abdominal keel, were present, as on the specimen from which the original description was taken.

S. GARMAN.

Cambridge, Mass., March 11.

The Quebec group.

Thinking it may be interesting to geologists to learn the latest conclusions in reference to the stratigraphical succession and distribution of the rocks in the province of Quebec, hitherto known as the 'Quebec group,' I send you the following brief observations on this subject: —

As is well known, the divisions made by my predecessor, the late Sir W. E. Logan, of this interesting and exceedingly complicated group of formations, were in ascending order, — Levis, Lauzon, and Sillery, — and these together were supposed to represent a peculiar phase of the calciferous and chazy formations of the New York lower paleozoic series. I have elsewhere made known as the result of personal investigation that portions of several systems and formations had evidently been included in the Quebec group as described in the 'Geology of Canada, 1863,' and depicted on the geological map of Canada, published in 1866. During a personal examination of a large portion of the area during the seasons of 1876, 1877, and 1878, I recognized strata which I

considered clearly belonged to systems and formations ranging from pre-Cambrian to Silurian; and also that much of the so-called 'Sillery' was in reality not the youngest, but the oldest member of the group, and of pre-Cambrian age.

All subsequent investigation has confirmed the correctness of these conclusions, first advanced in a paper read before the Natural history society of Montreal in February, 1879, and more fully treated in reports and papers since published in 1880, 1883, and 1884. Since the date of the last of these publications, considerable additional information relating to the distribution of the several formations has been acquired; and I now find that no less than four distinct horizons can be recognized, each of which is marked by important bands of conglomerate. Three of these (Nos. 2, 3, and 4) are fossiliferous limestone conglomerates, while one (No. 1) is chiefly felspathic and dioritic, is non-fossiliferous, and generally presents the appearance of a volcanic agglomerate or breccia, which in places becomes a brecciated serpentine, or is otherwise variously altered, and is often schistose and micaceous, — pre-Cambrian.

No. 2 is of Cambrian age, and is best seen along the south shore and at the north end of the Island of Orleans, at Bic, at Metis, and at several points lower down, on the south side of the St. Lawrence Gulf.

No. 3 is the celebrated Levis conglomerate, well exposed at Point Levis and at the south-west end of the Island of Orleans. It is interbedded with gray and dark blue highly graptolitic slates, recognized by Professor Lapworth as marking the phyllograptus zone of Europe. It also recurs with its associated phyllograptus slates at several points between Metis and the Marsouin River on the south shore of the St. Lawrence, always in discordant contact with the strata of the preceding group.

No. 4 is the limestone conglomerate of the Quebec Citadel Hill. It occurs there in three or four more or less lenticular beds, none of which exceed six feet in thickness: they are associated and interbedded with black highly carbonaceous and graptolitic strata, yielding a valuable cement-stone. Both to the north-east, before reaching the Island of Orleans, and to the south-west, these beds are cut off by the curving line of the great St. Lawrence and Champlain or Appalachian fault, and are brought into abrupt contact with the red and greenish gray slates of No. 2. They appear again, however, on the south side of the St. Lawrence near St. Antoine, and thence pass beneath the drift-covered level country to the south-west. I believe these beds to be a part of the Utica, Hudson River, or Lorraine group. Professor Lapworth, who has recently examined the graptolitic fauna from these rocks, considers it to denote a stage older than Trenton limestone, but decidedly newer than the Levis phyllograptus zone. The latter view is entirely in accord with the stratigraphical evidence as first published by me in 1879; but, so far as the stratigraphy is at present known, it is as decidedly opposed to the former conclusion. Lists by Professor Lapworth, of the graptolites from the different horizons above named, will appear in the volume of the Transactions of the Royal society of Canada, shortly to be published.

The fauna of No. 2 conglomerate, as well as that of the associated slaty and shaly beds, is exclusively of Cambrian type, — *Dictyonema sociale*, *Eophyton Linneanum*, *Cruziana* (?) *Paradoxides-Archaeocyathus*, etc.

The fauna of No. 3 conglomerate is mixed Cambrian and lower Cambro-Silurian, while that of the associated slaty beds is exclusively lower Cambro-Silurian.

The fauna of No. 4, though also mixed, is chiefly of Trenton Lorraine age, as is that of the associated slates.

The mineralogical and lithological characters of the four groups are as markedly different as are their paleontological features, and the former present a striking correspondence with those which characterize the pre-paleozoic and lower paleozoic formations of the Lake Superior region.

Altogether the structure in the vicinity of Quebec seems to correspond very closely with that described by Mr. S. W. Ford in his 'Observations upon the great fault in Rensselaer county' (*Amer. Journ. sc.*, vol. xxix, January, 1885).

In the Quebec area the great fault not only exists, but has many subordinate and more or less parallel branches. The most important of these crosses the main Quebec anticlinal at Danville, in Shipton township, and runs thence south by the Missisquoi valley to Mansonville, in the township of Potton, on the Vermont boundary. In many places these dislocations have, as described by Mr. Ford (*op. cit.*), placed the older rocks on the top of the newer. Such an occurrence is well seen in the gorge of the Nicolet River near Danville, where the black Cambro-Silurian limestones and shales dip directly under gray wrinkled quartzose pre-Cambrian mica-schists, and one would suppose the two series to be in conformable sequence; but not far removed, in the township of Tingwick, a small outlier of the same black limestone rests flat on the upturned edges of the mica-schists, as do other similar outliers elsewhere in the district.

It is quite evident that Appalachian geology can never be satisfactorily interpreted and explained without careful and minute study in the field of the numerous great shoved, more or less parallel, faults by which the whole region has been affected, and due consideration given to the marvellous effects they have produced on the structure.

ALFRED R. C. SELWYN.

Ottawa, Can., March 9.

Notes upon the erosive power of glaciers as seen in Norway.

The above heading is the title of a paper in course of preparation, of which the following is a *résumé* in part:—

(a) As many of the Norwegian glaciers are rapidly advancing, they arch over from rock to rock, and leave sub-glacial caverns into which the explorer can go long distances.

(b) Numerous angular and sub-angular stones, as well as those rounded by atmospheric erosion, are resting upon the crystalline rocky beds with the ice flowing about them; that is to say, the resistance due to the friction between the stones and the rock is greater than the cohesion of the molecules of the ice, which flow about the obstacles as a viscous body. Even stones resting upon loose and soft morainic matter, over which the glacier is advancing, are sufficient to channel the ice as it moves over, in place of pushing it along.

(c) No blocks were seen in the act of being torn

up from the subjacent rock, nor were the loose stones being picked up.

(d) A large rounded boulder, held in the ice, was being rolled, in place of shoved, along by glaciers, as shown by the mouldings in the ice. At the same time, it was being crushed.

(e) The abrasion by the falling of detached masses of ice and stones is considerable.

(f) A tongue of ice, hanging from the roof of a cavern, was pressing against a loose boulder, that a man could have moved. In place of pushing the stone, or moving around it, the tongue of ice, of about a cubic yard, was being held suspended by a sheet of ice bent backward, nearly at right angles, in a graceful curve.

(g) Scratched stones were rarely seen among those falling out of the bottoms of glaciers, and in many places the rocks were scarcely, if at all, scratched. Although occasionally highly polished, the subjacent rocks, even where scratched, showed generally surfaces roughened by weathering, or with only the angles removed.

(h) The upper layers of ice were seen to bend and flow over the lower, wherever low barriers were met with, in place of the lower strata being pushed up by an oblique thrust.

(i) A glacier was advancing into a morainic lake, and, in part, against the terminal barrier. In place of ploughing up the obstruction, the strata of ice were forced up into an anticlinal, along whose axis there was a fracture and fault. Thus domes of ice covered with sand were produced. The sand had been deposited upon the surface of glaciers by the waters of the lake. The conformability of the sand and the strata of uplifted ice was undisturbed, except along the line of fault. As the domes melt, cones of sand with cores of ice are left. By the lifting process the morainic barrier is covered with clayey sand, as if subjacent strata had been ploughed up by the glacier, of which there was no evidence.

(j) At several places where glaciers are advancing over moraines, they are levelling them, and not ploughing them out. This levelling process is by the dripping of the water from the whole under surface. In fact, even the loose stones upon the water-soaked moraines were sufficient resistance to cause the bottom of the ice to be grooved.

(k) The fall of a great ice-avalanche from a high snow-field, down a precipice of a thousand feet, to the top of a *glacier rémané* was seen. These falling masses of ice bring down the frost-loosened stones from the sides of the mountains upon the glacier, which is charged with *détritus*. It is this material which furnishes mud to the sub-glacial streams, and not the rocky bed of the valley worn down by glacial erosion.

(l) One does not find that the glaciers *per se* are producing hummocks. These are the result of atmospheric and aqueous erosion, although perhaps beneath a glacier, which sweeps over them, and to some extent scratches and polishes them. The effects of glaciation in removing angles and in polishing surfaces are small compared with atmospheric erosion upon the same rocks.

(m) The transporting power of glaciers is limited to the *débris*, which falls upon its surface from overhanging or adjacent cliffs, and afterwards works through the mass or comes to be deposited at its end.

J. W. SPENCER.

University of Missouri, Feb. 28.